

REMARKS

Attached hereto is a marked-up version of the changes made to the application by this Amendment. Reconsideration and allowance of the subject application are respectfully requested.

Upon entry of this Amendment, claims 1-29 will be pending in the present application. Claims 1, 12, and 22 are independent claims.

REJECTIONS BASED ON 35 U.S.C. §112, SECOND PARAGRAPH

The Examiner rejected Claim 15 under 35 U.S.C. §112, second paragraph as failing to set forth the subject matter which applicant regards as his invention. The Examiner asserts that if the statement that the first plasma is a non-reactive gas is true, then the gas would have no effect on the binding force in the uncovered portion of the metal layer. In the Examiner's view, the first plasma must be a reactive gas either in a physical or chemical manner. Applicant respectfully traverses.

It is well understood in U.S. patent law that an inventor may be his or her own lexicographer as long as the meanings are not antagonistic to commonly understood usage. *Autogiro Co. of Am. v. U.S.*, 384 F.2d 391, 397 (C.C.P.A. 1967). It is also well understood that once a meaning is established it will carry its denotations and connotations unless specifically disclaimed in the specification.

In this case, the Applicant has provided the intended meaning in the specification for the term "non-reactive" and is consistent in the application of that meaning to claim 15. Particularly, page 6, line 21 through page 7 line 2 of Applicant's Specification defines the use of the term non-reactive as follows:

When using the non-reactive gas, such as the Ar or N₂ plasma gas, the binding force of the surface of the metal layer 44 becomes depressed physically. In particular, Ar or N₂ ions physically strike the surface of the metal layer 44, thereby breaking chemical bonds and lowering the overall binding force of the metal layer.

Applicant's Specification at Page 6, line 21

The Examiner also admits that gases such as Ar may lower the binding force in a metal layer. Therefore Claim 15 does not fail to set forth the subject matter which applicant regards as his invention and withdrawal of the Examiner's rejection under 35 U.S.C. §112, second paragraph is respectfully requested.

REJECTION OF CLAIMS UNDER 35 U.S.C. § 102(b)

Claims 1-3, 7-9, 11-13, 20-22, 28 and 29 have been rejected by the Examiner under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,771,110 to Hirano et. al. (Hirano) for the reasons set forth in the Office Action. Applicant respectfully traverses.

Hirano teaches forming a resist pattern on an indium tin oxide film (ITO film), and then etching the film by RIE initially employing hydrogen bromide

gas (HBr). The HBr gas is used to etch down to the silicon dioxide film. Once exposure of the silicon oxide film is started with HBr gas, a switch to chlorine gas (Cl₂) is made in order to complete the etching process initially begun with HBr. Therefore, Hirano teaches using a first plasma to etch (not treat) an ITO film, then to use a second plasma to also etch an ITO film. The first plasma gas employed in Hirano (HBr) is not used for treating a metal layer prior to etching, but is rather used to perform the actual process of etching. Therefore, Hirano does not teach "exposing the uncovered portion of the metal layer to a first plasma, prior to etching, to lower a binding force in the uncovered portion; and etching the uncovered portion of the metal layer with a second plasma" as recited in amended claim 1, and similarly stated in claims 12 and 22.

The other claims depend either directly or indirectly from either independent claims 1, 12 or 22 and therefore are patentably distinguishable over Hirano at least for the reasons discussed above. In view of the above remarks, reconsideration and withdrawal of the art grounds of rejection are respectfully requested.

REJECTION OF CLAIMS UNDER 35 U.S.C. §103(a)

The Examiner rejected claims 5, 6, 15, 16 and 24 under 35 U.S.C. 103(a) over Hirano (as applied to claims 1, 12, and 22) in view of Tsou. Applicant respectfully traverses.

Tsou teaches a method of etching a thin layer of indium tin oxide deposited on a substrate by subjecting the layer of indium tin oxide to reactive ion etching in a plasma containing dissociated hydrogen bromide or a mixture of dissociated hydrogen bromide and optionally, dissociated boron trichloride. The method of etching in Tsou further teaches various mixtures combining the above-identified reactive gases with one of a group of non-reactive gases consisting of Ar, He and N₂. Tsou does not, however, disclose or suggest a step of treating as distinguished from a step of etching as claimed in independent claims 1, 12, and 22. Therefore Tsou, like Hirano does not disclose or suggest treating the exposed portion of the metal layer with a first plasma, prior to etching, using the photoresist pattern as a mask, to lower a binding force in the exposed portion as recited in independent claim 1, and similarly stated in claims 12 and 22.

Claims 5, 6, 15, 16 and 24, dependent on claims 1,12, and 22, are patentable for the reasons stated above with respect to claims 1, 12, and 22 as well as on their own merits.

The Examiner rejected claims 10, 17-19, and 25-27 under 35 U.S.C. §103(a) over Hirano in view of Ye et. al. (Ye) asserting that Ye teaches a plasma that includes both HBr and CH₄ for removing a metal layer. Applicant respectfully traverses.

Ye teaches a copper etchback process that is based on physical bombardment combined with an etchant species, which is chemically reactive with copper, preferably, a halogen-containing compound. The copper etchback process of Ye does not, however, disclose or suggest a step of treating as distinguished from a step of etching as claimed in independent claims 1, 12, and 22. Therefore Ye, like Hirano (argued above) does not disclose or suggest treating the exposed portion of the metal layer with a first plasma, prior to etching, using the photoresist pattern as a mask, to lower a binding force in the exposed portion as recited in independent claim 1, and similarly stated in claims 12 and 22.

Claims 10, 17-19, and 25-27, dependent on claims 1,12, and 22, are patentable for the reasons stated above with respect to claims 1, 12, and 22 as well as on their own merits.

Claims 4, 14 and 23 have been rejected by the Examiner under 35 U.S.C. §103(a) over Hirano in view of Mohri et. al. (Mohri) asserting that it would have been obvious to use the H₂ plasma gas of Mohri in the first plasma of Hirano in order to etch fine patterns in the metal layer. Applicant respectfully traverses.

Mohri teaches a method of etching an ITO layer using a combination of HBr and H₂. The etching process of Mohri does not, however, disclose or suggest a step of treating as distinguished from a step of etching as claimed in independent claims 1, 12, and 22. Therefore Mohri, like Hirano (argued above)

does not disclose or suggest treating the exposed portion of the metal layer with a first plasma, prior to etching, using the photoresist pattern as a mask, to lower a binding force in the exposed portion as recited in independent claim 1, and similarly stated in claims 12 and 22.

Claims 10, 17-19, and 25-27, dependent on claims 1,12, and 22; are patentable for the reasons stated above with respect to claims 1, 12, and 22 as well as on their own merits.

CONCLUSION

Applicant considers all of the Examiner's comments to have been addressed and all of the Examiner's rejections overcome, thereby placing all claims pending in the present Application in condition for allowance. Accordingly, a Notice of Allowability is solicited in earnest.

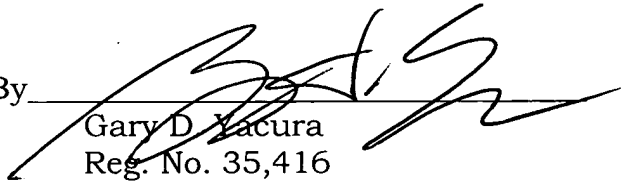
In the event that any outstanding matters remain in this application, Applicant requests that the Examiner contact Gary D. Yacura (Reg. No. 35,416) at (703) 205-8071 to discuss such matters.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By


Gary D. Yacura
Reg. No. 35,416

GDY/PLS/kmr:sld

P.O. Box 747
Falls Church, VA 22040-0747
(703) 205-8000

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

The claims have been amended as follows:

1. A method of manufacturing a liquid crystal display device, comprising:
forming a switching element on a substrate;
forming a passivation layer over the substrate;
depositing a metal layer on the passivation layer;
forming a photoresist pattern on the metal layer, such that a portion of the metal layer is exposed;
treating the exposed portion of the metal layer with a first plasma, prior to etching, using the photoresist pattern as a mask, to lower a binding force in the exposed portion; and
etching [removing] the treated portion of the metal layer to form a pixel electrode.
12. (Amended) A method of manufacturing a pixel electrode in a liquid crystal display device, comprising:
depositing a metal layer on a passivation layer which partially covers a transistor;

forming a photoresist pattern on the metal layer, leaving a portion of the metal layer uncovered;

exposing the uncovered portion of the metal layer to a first plasma, prior to etching, to lower a binding force in the uncovered portion; and

etching [removing] the uncovered portion of the metal layer with a second plasma to form a pixel electrode.

22. (Amended) A method of patterning a metal layer, comprising:

depositing a metal layer over a substrate;

forming a mask on the metal layer, leaving a portion of the metal layer uncovered;

exposing the uncovered portion of the metal layer to a first plasma, prior to etching, to lower a binding force in the uncovered portion; and

etching [removing] the uncovered portion of the metal layer with a second plasma to form a metal pattern.